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Students First!

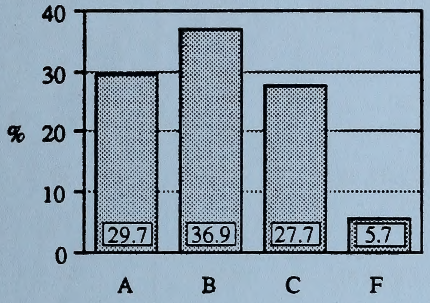
Student Evaluation

EXAMINERS' REPORT
JUNE
1990

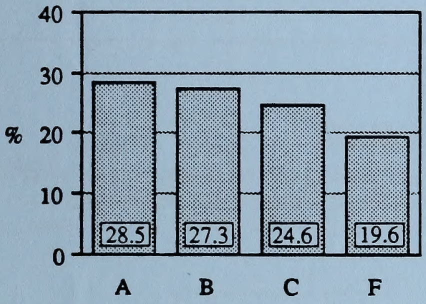
CANADIANA
OCT - 5 1990

Physics 30 Diploma Examination Results

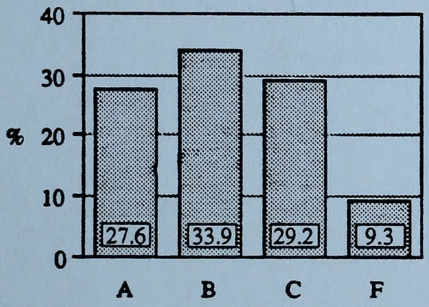
SCHOOL-AWARDED MARK



DIPLOMA EXAM MARK



FINAL BLENDED MARK



The summary information in this report is intended to provide teachers, school administrators, students, and the general public with an overview of results from the June 1990 administration of the Physics 30 Diploma Examination. The information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. The first annual provincial report containing a detailed analysis of the combined January and June results is available this fall.

DESCRIPTION OF THE EXAM

The Physics 30 Diploma Examination consists of two parts: a multiple-choice section of 49 questions worth 70% and a written-response section of four questions worth 30%.

ACHIEVEMENT OF STANDARDS

The information reported is based on the final blended marks achieved by 4 768 students who wrote the June 1990 examination.

- 90.7% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 27.6% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

PROVINCIAL AVERAGES

- The average school-awarded mark was 70.3%.
- The average diploma exam mark was 66.4%.
- The average final blended mark, representing an equal weighting of the diploma and school marks, was 68.8%.

Alberta
EDUCATION

SUBTEST RESULTS

When analysing any detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Machine scored: 34.6 out of 49

Written response: 11.9 out of 21

- Course Content
  - Light: 11.2 out of 16
  - Electric and Magnetic Fields: 12.5 out of 19
  - Electromagnetic Radiation: 6.0 out of 10
  - Structure of Matter: 9.5 out of 14
  - Modern Physical Theories: 7.4 out of 11
- Process Skills: 22.4 out of 36
  - Multiple-choice questions 1, 3, 7, 9, 13, 17, 20, 21, 23, 26, 27, 28, 29, 30, 33, 40, 42, 45, and 48, and written-response questions 1, 2, and 4.
- Cognitive Levels
  - Knowledge: 12.0 out of 17
  - Comprehension and Application: 24.2 out of 35
  - Higher Mental Activities: 10.3 out of 18

EXAMINATION BLUEPRINT

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in June 1990 according to these classifications. Numbers with square brackets [ ] indicate written-response questions, and those without brackets indicate multiple-choice questions.

Reporting Category	Questions by Cognitive Level			Examination Emphasis (%)
	Knowledge	Comprehension and Application	Higher Mental Activities	
Light	2, 6, 8, 10	1, 3, 4, 5, 7, 9, 11	[4]	23
Electric and Magnetic Fields	14, 15, 16, 19	12, 13, 18, 21, 22 [1]	17, 20, 23	27
Electromagnetic Radiation	24, 25	26, 28	27 [2]	14
Structure of Matter	31, 35, 38	30, 32, 34, 36, 37 [3]	29, 33	20
Modern Physical Theories	39, 41, 46, 47	42, 43, 44, 45, 49	40, 48	16
Examination Emphasis (%)	24	50	26	100

RESULTS and EXAMINERS' COMMENTS

The examination has a balance of question types and difficulties and is designed so that a student capable of achieving the acceptable standard would obtain a mark of 50% or better on the examination. Students achieving the standard of excellence would obtain a mark of 80% or better on the examination.

MULTIPLE CHOICE

QUESTION	KEY	DIFFICULTY*	QUESTION	KEY	DIFFICULTY	QUESTION	KEY	DIFFICULTY
1	C	77.7	18	B	75.9	35	C	69.1
2	B	76.8	19	A	73.3	36	B	63.8
3	D	69.5	20	B	61.3	37	A	78.3
4	B	74.9	21	C	60.0	38	D	80.1
5	B	79.6	22	D	85.8	39	D	47.5
6	C	88.3	23	A	77.5	40	D	68.7
7	A	85.3	24	D	73.4	41	A	70.1
8	C	62.2	25	C	87.7	42	C	80.6
9	C	83.2	26	A	74.9	43	B	84.3
10	D	61.2	27	B	69.5	44	B	77.5
11	B	62.6	28	A	66.1	45	D	73.2
12	C	73.9	29	D	69.2	46	D	67.0
13	B	65.0	30	B	58.0	47	C	57.2
14	C	63.8	31	C	71.2	48	A	64.5
15	B	87.9	32	C	76.2	49	A	49.5
16	C	59.4	33	D	54.7			
17	A	45.7	34	A	76.5			

*Difficulty – percentage of students answering the question correctly

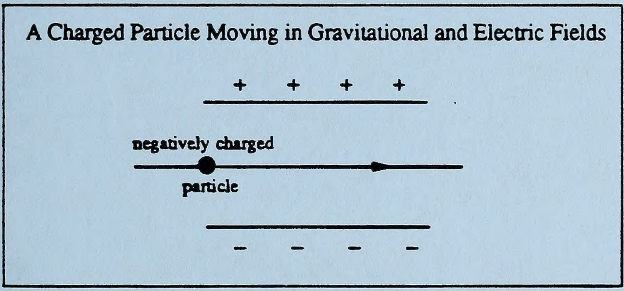
MULTIPLE CHOICE (continued)

All students were expected to demonstrate a high level of competence in calculations; most met this expectation. Students achieving the standard of excellence were expected to transfer knowledge to new situations and to use methods based on major scientific generalizations. Questions 3, 11, 17, 27, 33, and 45 were designed to test students' abilities to analyse and generalize. Detailed comments on questions 18 and 33, which illustrate the varying question types and difficulty levels included in the examination, follow. •

18. **What will be the speed of an electron that accelerates from rest through a potential difference of 5.0×10^2 V?**

A. 9.4×10^6 m/s
•B. 1.3×10^7 m/s
C. 1.8×10^{14} m/s
D. 3.3×10^{16} m/s

Question 18 required students to apply the law of the conservation of energy to a charged particle that has been accelerated by an external voltage. To perform this calculation, students had to combine two equations from the *Physics Data Booklet.* Over three-quarters of the students obtained the correct answer, including half the students whose examination scores were below 50%. Alternatives C and D each drew over 8% of the students. All students should have eliminated these two alternatives because the speeds given are faster than the speed of light in a vacuum. Even when using modern calculators, students need to check their answers to see if the answers make sense.



A Charged Particle Moving in Gravitational and Electric Fields

33. **A negatively charged particle of mass 3.0×10^{-14} kg moves horizontally through a vertical electric field of intensity 6.1×10^4 N/C. The number of excess electrons on the particle is**

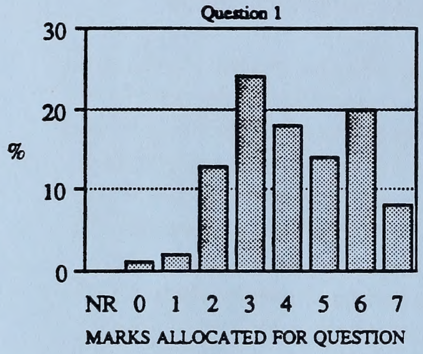
A. 0.3
B. 1
C. 3
•D. 30

Question 33 required students to recognize that horizontal motion implies a zero vertical force. Secondly, students had to equate electric force with particle weight, even though the initial data are expressed in terms of electric field and particle mass. Finally, students had to convert the charge in coulombs into the units of elementary charges. Nearly all students whose examination marks were over 80% obtained the correct answer. Most students whose examination marks were below 50% confused mass and weight; fewer than one-fifth of them obtained the correct answer.

Unlike the January 1990 examination, students performed better than they had been expected to, based on the initial field-test results.

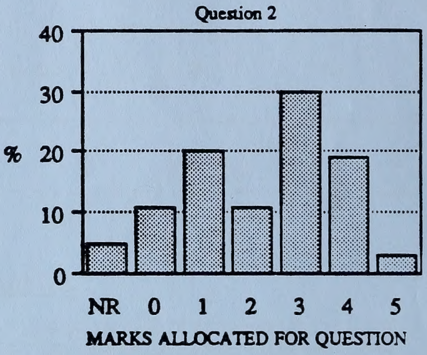
WRITTEN RESPONSE

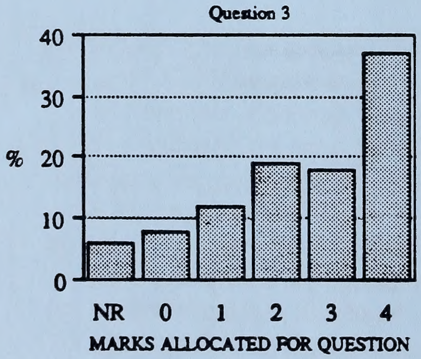
The four questions in the written-response section were chosen from four of the five content strands for physics. Students' problem-solving skills were tested most in part (c) of question 1 and in question 2. Students performing at the acceptable standard were expected to answer the first two parts of question 1 well, to obtain half marks on questions 3 and 4, and to be challenged by question 2. Students performing at the standard of excellence were expected to answer questions 3 and 4 almost perfectly and to get two-thirds or more of the marks on questions 1 and 2.



Question 1 was well answered. Most students drew the straight-line graph, many calculated the slope, and a significant proportion derived the charge q from the equation $mg = qE$. Students were expected to use the slope as the most suitable averaging procedure because the greatest statistical weight is then given to the most accurate points. Using the data table is an inferior method because, in this case, equal statistical weight is given to each point on the graph. Substituting average values for V and d in the equation $qV/d = mg$ was only accepted if students drew a straight-line graph that went exactly through the origin. On this 7-mark question, the average mark was 4.17 for 59.6% of the available mark.

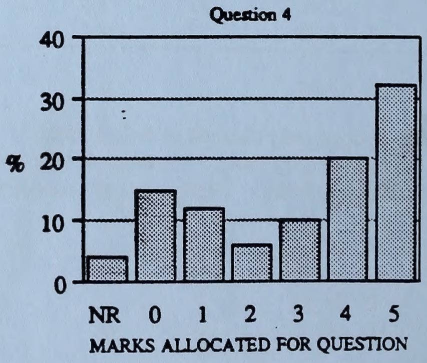
Question 2 had responses that showed great variability. The relative sizes of the holes and of the microwaves were well documented, showing that students understood that the mesh was opaque to microwaves. Students, however, were unaware that light had to pass through the mesh. In estimating the harmful nature of microwaves, most students exaggerated the carcinogenic properties of microwaves, but few commented on the negative effects of microwaves on some models of heart pacemakers. The alternative designs, some of which were successful, made for interesting reading. On this 5-mark question, the average mark was 2.24 for 44.8% of the available mark.





Question 3 was well answered. Many students used unit analysis to determine the formula for the mass of gold that was deposited. About half the students used the hypothetical mass of 36.0 g. Those students who calculated an incorrect mass and then used the hypothetical mass for the second part of the question received part marks for the first part and full marks for the second part. On this 4-mark question, the average was 2.51 for 62.8% of the available mark.

Question 4 showed a great variance in student responses. Many students included clear documentation and a correct answer. A significant minority of students, however, included an angle of 71.6° to the surface and an angle of 38.0° to the normal as substitutions into Snell's Law. It was encouraging to see that three-quarters of the students knew that both straight-line propagation and refraction were essential elements to the solution. On this 5-mark question, the average mark was 2.97 for 59.4% of the available mark.



For further information, contact Phill Campbell or Jack Edwards at the Student Evaluation Branch, 427-2948.